



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

Address: COMMISSIONER FOR PATENTS

P.O. Box 1450

Alexandria, Virginia 22313-1450

www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

10/520,495

01/05/2005

Fulvio Costa

033965.005

9871

25461 7590 07/10/2009
SMITH, GAMBRELL & RUSSELL
SUITE 3100, PROMENADE II
1230 PEACHTREE STREET, N.E.
ATLANTA, GA 30309-3592

EXAMINER

EMPIE, NATHAN H

ART UNIT

PAPER NUMBER

1792

MAIL DATE

DELIVERY MODE

07/10/2009

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/520,495

Applicant(s)

COSTA ET AL.

Examiner

NATHAN H. EMPIE

Art Unit

1792

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03 June 2009.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 21, 24-27, 29-34, 36 and 38-40 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 21, 24-27, 29-34, 36 and 38-40 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submissions filed on 6/3/09 and 4/29/09 has been entered.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 21, 24-27, 29-34, 36, and 38 – 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kim et al. (Surface Modified SiO₂ Xerogel films from HMDS / Acetone for Intermetal Dielectrics, paper from 2000 International Microprocesses and Nanotechnology Conference, 11-13 July 2000; hereafter Kim) in view of Minami et al (US 2002/0160153 A1; hereafter Minami).

Claims 21, 24, 25, and 36: Kim teaches a process for the preparation and deposition of a vitreous film (SiO_2 xerogel film) on a substrate (such as silicon) (pg 218-219) comprising:

Preparing a solution in an aprotic solvent (acetone) of at least one alkoxide such as tetraethylorthosilicate (TEOS) (see, for example, pg 218, last paragraph)

Adding a catalyst to the solution (catalyst / such as HCl) (see, for example, pg 218, last paragraph)

Hydrolyzing the solution in the presence of the catalyst (HCl) in a hydrolysis reaction by addition of water to maintain a molar ratio of H_2O / Me between 0.5 and 5 to obtain a clear (transparent) hydrolysis reaction product (see, for example, pg 218, last paragraph, wherein the molar ratio of added H_2O / Me (Si) is taught to be controlled at 2.5);

Depositing the hydrolysis reaction product in the form of a sol on the substrate ("this sol was spun on a p-type Si (100) substrate" (see, for example, pg 218, last paragraph)).

Kim further teaches wherein shrinkage, cracking, and collapse of structure of the sol-gel coating are considerations that can be deleterious to film performance so they should be addressed (see, for example, pg 218 paragraphs 1-3), Kim further teaches a hydrolysis process which would inherently produce an alcohol byproduct (see, for example, pg 218, paragraphs 1-3), but Kim does not explicitly teach the removal of the alcohol byproduct formed by the hydrolysis process. Minami teaches a method of forming a sol-gel derived film by a hydrolysis process involving a metal alkoxide in a

solvent (see, for example, [0008]-[0023]). Minami further teaches that shrinkage and cracking of the resulting film can be prevented by partial and controlled desolventization (evaporating the alcohol and water which are the products from the reaction of the sol-gel material, see, for example, [0041]). Minami further teaches removing the alcohol formed during the hydrolysis reaction is performed under reduced pressure (see, for example, 0041]). Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to have incorporated a step of evaporating alcohol byproduct from the sol under reduced pressure, as taught by Minami, into the method of Kim as it help to reduce shrinkage and cracking in the final coating.

Claim 26: Kim further teaches wherein the solution of the alkoxide in aprotic solvent possesses a TEOS : Acetone molar ratio is 1:4 (see, for example, pg 218, last paragraph), which yields an approximate weight % of the alkoxide in the solvent of ~57% (FW TEOS ~208.32g/mol, FW acetone~58.08)

Claim 27: Kim further teaches wherein hydrolyzing of the alkoxide is accomplished by adding a controlled quantity of water (hydrolysis process for sol is preferably contains 2.5 mol of water, (see, for example, pg 218, last paragraph)).

Claims 29 – 30: Kim further teaches wherein the molar ratio of H_2O / Me (Si) is 2.5 (see, for example, pg 218, last paragraph);

Claims 31 – 33: Kim further teaches where hydrolyzing of the alkoxide is accomplished in the presence of an acid catalyst selected from the group consisting of mineral and organic acids with K_a of 0.1 to 3, further an aqueous solution of HCl, (see,

for example, pg 218, last paragraph), wherein a molar ratio of alkoxide / acid is 1/.0018 (see, for example, pg 218, last paragraph).

Claim 34: Kim further teaches wherein a molar ratio of alkoxide / acid is 1/.0018 (described in the rejection above), and Kim additionally teaches that by varying the catalyst concentration will influence on the transparency of sol and gelling time (see, for example, pg 218, last paragraph). Kim does not explicitly teach that the molar ratio of alkoxide to acid is preferably from 1/0.1 to 1/0.01, but it would have been obvious to one of ordinary skill in the art at the time of invention to have incorporated such a ratio within such a claimed range since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Claims 38 – 39: Kim further teaches wherein the coating is deposited by spin coating (see, for example, pg 218, last paragraph).

Claim 40 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kim in view of Minami as applied to claim 21 above, and further in view of Ravaine et al (US patent 4,923,950; hereafter Ravaine).

Claim 40: Kim in view of Minami teaches the method of claim 21 (described above), and Kim further teaches wherein it is known in the art to use dried SiO₂ xerogel films for intermetal dielectrics (pg 218-219), but Kim is silent as to a specific drying temperature; therefore Kim in view of Minami does not explicitly teach a final drying at a

temperature of 20 to 500°C. When a primary reference is silent as to a certain detail, one of ordinary skill would be motivated to consult a secondary reference which satisfies the deficiencies of the primary reference. Ravaine teaches a method of forming a sol-gel derived film by a hydrolysis process involving a silicon alkoxide in a solvent (see, for example, abstract, col 3 lines 26 – 50). Ravaine further teaches that to form a xerogel, all of the alcohols and water must be removed from the gel by drying at a temperature around 120°C (col 3 lines 44 – 50) . Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to have incorporated a temperature of around 120°C, as taught by Ravaine, as the drying temperature for the dried xerogel in the process of Kim in view of Minami, as Kim was silent and such a temperature is taught to predictably dry the gel to form a xerogel.

Response to Arguments

Applicant's remaining arguments filed 4/29/09 directed to the claim rejections under 35 USC 103 over Kim / Minami / Ravaine have been fully considered but they are not persuasive.

Applicant's arguments that the references do not teach the newly added limitations are unconvincing in view of the Kim and Minami references, as discussed above.

In response to applicant's arguments against the references individually (i.e. "...the Kim article does not disclose or suggest the step of removing alcohol that is formed during the hydrolysis reaction...", "Ravaine does not describe the hydrolyzation

of the alkoxide solution in an aprotic solvent, followed by the removal of the solvent"), one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). The examiner asserts that Minami is relied upon for teaching the removal of alcohol.

In response to applicant's assertion that Minami "does not describe the removal of the ethanol which is produced by the hydrolyzation of the alkoxides" (pg 7 of remarks filed 4/29/09), the examiner asserts that Minami teaches a method of forming a sol-gel derived film by a hydrolysis process involving a metal alkoxide in a solvent (see, for example, [0008]-[0023]), and has explicitly taught "it is preferable to evaporate the solvent and water contained in the solution and the alcohol and water which are products from the dehydration and polycondensation reaction of the above sol-gel material"... "thereby the shrinkage of the formed film is suppressed as much as possible, whereby the occurrence of cracks on the film can be prevented and the cured film can be formed without the occurrence of air bubbles in the film"... (both passages from [0041]). Further in response to applicant's argument that there is no suggestion to combine the Kim and Minami references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d

1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, it would have been obvious to one of ordinary skill in the art at the time of invention to have incorporated a step of evaporating an alcohol byproduct from the sol, as taught by Minami, into the method of Kim (wherein an alcohol byproduct is produced by the hydrolysis process of Kim) as Minami has explicitly taught such a step would help to reduce shrinkage and cracking in the final sol-gel derived coating.

In regards to applicant's arguments directed to the rejection of claim 40, the examiner would like to emphasize that claim 40 is rejected over Kim in view of Minami and Ravaine (not just Kim and Ravaine, as argued by applicant). Again the argued alcohol removal step has been taught by Minami, as described in the final office action of 12/3/08, and in the preceding paragraphs.

As to the remaining dependent claims, they remain rejected as no separate arguments are provided.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to NATHAN H. EMPIE whose telephone number is (571)270-1886. The examiner can normally be reached on M-F, 7:00- 4:30 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Cleveland can be reached on (571) 272-1418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/N. H. E./
Examiner, Art Unit 1792

/Michael Cleveland/
Supervisory Patent Examiner, Art Unit 1792